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power displayed in the researches from which these predictions resulted, or of their deserved prominence in the history of astronomy.

Among the various researches which were subsequently undertaken by Adams, that relating to the secular variation of the Moon's mean motion was perhaps the most interesting and important. This investigation reopened a question which had been regarded as finally settled by Laplace. Adams detected an omission in the work of his predecessor, which, when supplied, proved to disturb the agreement previously supposed to exist between theory and observation. A new physical cause was now required to explain the observed results, and this was found in the retardation of the rotation of the Earth due to the tides. In this case, a protracted discussion of the subject among the foremost mathematicians who concerned themselves with astronomical inquiries resulted in confirming the theory maintained by Adams. But the amount of the secular variation forming the original subject of discussion has not yet been definitely fixed by observation. At present it seems probable that the researches of Adams brought theory into better accordance with fact, instead of disturbing an existing agreement. If this view should prevail, tidal retardation must be regarded as compensated by terrestrial contraction, or by causes as yet unknown.

The orbit of the remarkable body of meteors to which is due the recurrence of brilliant displays of shooting stars about the middle of November, three times in each century, was another subject investigated by Adams with great success. In general, it may be said that in all the principal discussions of his time respecting recondite questions of theoretical astronomy he took a prominent part, and that no arguments were regarded with more respect than his by those capable of appreciating them.

Besides his academical honors, he received many tokens of distinction from learned societies, and his name was familiar, as it will long continue to be, wherever the mechanism of the solar system is discussed or studied.

GEORGE BIDDELL AIRY.

GEORGE BIDDELL AIRY was born at Alnwick, England, July 27, 1801. His university education was obtained at Cambridge, where his mathematical ability became conspicuous, and where he graduated as Senior Wrangler in 1823. In the following year he was elected a Fellow of Trinity College; in 1826 he was made a Professor, and in 1828 the Director of the Observatory. These early honors were

abundantly justified by the number and excellence of the investigations which he began even before his graduation, and continued during the following years.

The results of his inquiries at this period were published in the Transactions of the Cambridge Philosophical Society, in memoirs relating to optical and astronomical subjects. The reader of these memoirs will not fail to observe, in addition to ingenuity and perspicuity, much evidence that they were written from a genuine love of inquiry, rather than from the desire for temporary reputation. Although their subjects seem at first not very closely connected, it appears that the later inquiries were suggested by facts developed in the course of those which preceded, and that the author was not looking for subjects on which to write, but was impelled to write by the abundance of material which spontaneously presented itself to his mind. As an incidental result of the optical studies in which he was engaged, he discovered and showed how to correct the peculiar defect of vision now so familiar to oculists under the name of astigmatism, which he found to exist in his own left eye. Probably a considerable number of physicians and of philosophers must have previously been inconvenienced in the same way without undertaking any experiments to discover the exact nature of the hindrance to distinct vision which existed in their cases.

Airy began work as a practical astronomer at a time when what we now understand as practical astronomy was an art as yet, comparatively speaking, unformed, — when much now taught in every text-book had to be discovered or neglected by the observer in proportion to his mental activity or indolence. Neglect was impossible to a mind so active and acute as Airy's; and while his great contemporary, Bessel, was making the way plain to future practical astronomers, Airy was finding it very successfully for himself. He early recognized and urged the necessity of carefully reducing all observations which are intended to contribute substantially to our knowledge, instead of resting satisfied with the observations themselves. Besides attending thoroughly to all the practical business connected with the management of the Cambridge Observatory, he continued the mathematical investigations which had previously occupied him. Among these should be specially mentioned the memoir on the inequality of long period in the motions of the Earth and Venus, for which the Gold Medal of the Royal Astronomical Society was awarded to him in 1832.

In 1835 Airy received the appointment of Astronomer Royal, and accordingly took charge of the Greenwich Observatory. Here he remained for forty-six years, finding such abundant opportunities for the exercise of his business abilities that his career as an investigator was

practically terminated by the acceptance of his new office. New instruments were to be planned, and their construction superintended; new branches of scientific work were to be introduced as part of the regular business of the Observatory; old observations were to be collected, reduced, and published; the methods of making and reducing new observations were to be brought into systematic form; while, in addition to these occupations, demands from other departments of the national administration for advice and assistance in scientific matters were frequently to receive attention from the *Astronómer Royal*. Substantial progress in any science can only be made by the patient accumulation of observed facts under the guidance of capable administrators, such as Airy. His success in this field of work had to be accepted by himself and by his friends as amends for the withdrawal of his attention from the more strictly scientific problems which he had shown himself so well qualified to solve.

During his administration of the Greenwich Observatory its instrumental equipment was entirely renewed, and in many respects greatly enlarged; magnetic and meteorological observation, and long afterwards spectroscopic observation, were undertaken as parts of the prescribed system of work; the results of older and recent observations were made accessible to the scientific public in a long series of ponderous volumes, to which the astronomical investigators of this century have constantly resorted for an important portion of the facts needed in their studies. No enumeration of the details of Airy's work as *Astronomer Royal* will be attempted in this place; and as an individual student of nature little remains to be said of him, for the reasons above stated. But his interesting experiments at the Harton Colliery, in 1854, for the determination of the density of the Earth by the observation of pendulums at the surface of the ground and at the bottom of the mine, deserve mention in any notice of his life. In 1870 he began an elaborate investigation into the theory of the Moon's motion, by a new method; but, after pursuing it for many years in such time as was at his command, he found that old age forbade him to carry it further.

He resigned his position as *Astronomer Royal* in 1881, and lived in honored retirement for the ensuing ten years, dying on January 7, 1892, in consequence of an accidental fall some time before. Marrying in 1830, he became a widower in 1875. Six children survive him. He received the honor of knighthood in 1872, and a long series of other complimentary distinctions at various times in his life.

Besides his original researches, he published, chiefly in his younger days, various essays on scientific matters, distinguished by their accuracy and perspicuity.